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ERDA CONTRACT 2.1-9
GAME FARMING - PROVISION OF INFORMATION

Principal Investigator - Dr. J.C. Haigh MRCVS

Executive summary

91-01875/

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This project entailed the acquisition and distribution of information on the topic of game farming. Three main systems were used. The principal system was the preparation of a series of 24 pamphlets, entitled "Game Farming Practice" on various aspects of the management of game farm species. The main concentration was on the North American Elk (wapiti), with some emphasis on bison, and several pamphlets that could be applied across a spectrum of species. Another major means of information distribution was the organization of field days and workshop/seminars. These were targeted toward both industry and the veterinary profession.

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Abstract

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Background and Objectives

At the time of initiation of this project there was little or no published information available for game farmers in Saskatchewan (or indeed anywhere in Canada) on the farming of game species, especially wapiti. Such information was available from a very few individuals who were under a constant barrage of time consuming telephone calls and visits from prospective game farmers. It was my intent to provide this information in a reasonably technical form so that many segments of the industry would at least have an introduction, and in some cases a detailed discussion of the various aspects.

Methods

The major thrust was in the preparation of written materialfor distribution to any and all sectors of the industry. A mailing list was generated from game farmers organizations, government agricultural representatives, and any other interested parties who made contact. The list has been constantly updated to keep pace with demand.

Industry sector meetings were organised with the help of volunteers from the membership of the Saskatchewan Game Farmers Association (SGFA), the Canadian Game Farmers Association and personnel at the Western College of Veterinary Medicine (WCVM). For each of four meetings one at least one prominent speaker was invited from overseas, his travel money being provided through the project budget. Field days were also organised with the help of the SGFA.

One instructional videotape was made on the topic of velvet antler removal.. This was carried out employing the services of a professional photographer and the help of the department of Audio-visual Services at the University of Saskatchewan.

Results & Discussion

Two major association meetings were held, one in Swift Current, the other in Lloydminster. Out of province speakers included Dr. Tony English (Sydney, Australia) and Dr. Ken Throlson, (New Rockford, South Dakota) in the first year, and Tony Pearse (New Zealand) and Dr. Tony Bubenik (Ontario) in the second year. The full programs

for each meeting have been sent with previous reports.

Two meetings were held at the WCVM for members of the veterinary profession. The first of these attracted 24 delegates. The invited speaker was Dr. John Fletcher (Sotland). In the second year the meeting was held in conjunction with the Sask. Vet. Medical Association June conference. Dr. R. Butler of the WCVM assisted with organization. The invited speaker was Dr. Peter Wilson of Massey University in New Zealand. Forty-six persons registered. The programs have been sent under separate cover.

Field days were held at Saskatoon (3 times), Handel, Fairlight, Maidstone and Wowota. All speakers, with the exception of Dr. John Fletcher at Maidstone were from within the province.

Concusions & Impact

It is difficult for me to assess the impact that this project has had on Saskatchewan agriculture. From purely subjective point of view it would appear that the information has been well received. The mailing list, now world-wide, contains almost 1000 names. Many of the pamphlets have been back to the printers for second runs, this despite initial printings of 1500 or even 2000 copies. I understand from personnel at Saskatchewan Agriculture in Regina, as well as in numerous regional offices, that many photostat copies have been made to meet the demands of the public. Many of the articles have been abstracted, dissected and republished in a diversity of forms in England, the USA and Canada. Some of the efforts by other editors have been less than professional. Apart from game farm magazines, abstracts have appeared in veterinary association newsletters and llama magazines.

Pamphlets Prepared

Sedation & Immobilization
Choosing your bison
Administering drugs
Farm start-up - Choosing your elk
Elk farm start-up
Antlers
Velvet harvesting
Handling your elk
Orphan animals -1
Artificial rearing -2
Rompun Misuse
Calving, lactation, weaning
Reproductive management of elk
Wapiti- Seasonal Synchrony & Reproductive Behaviour
Feeding Wapiti on Game Farms
Handling Bison
Capture Myopathy
Tranquilizing Bison
Feeding Wapiti on Game Farms
Game Farming in Saskatchewan
Disease considerations
Brain & Muscle worms
Tuberculosis
Necrobacillosis

Talks given

Programs for each of the workshop/seminars are included separately. The three field days at Saskatoon were all held in conjunction with other meetings and had no formal talks presented.

Personnel

Principal	% of time
Dr. J.C.Haigh	10%
Other	
Pam Bowman - technical assistance	0.05%
Dr. R.J.Hudson - assisted with preparation of one pamphlet	<0.01%

PY goal

Equipment list

MacIntosh Computer	F6183BR
Imagewriter printer II	0723064
Laserwriter Printer	A6262WN
Hard disk 20	F6260Q0
Apple Modems x 2	C640877 / 9

Preliminary Announcement

Field Day

Saskatchewan Game Farmers Association

Saturday 6th June 1987

Location: TRAD (Loerzell) Farm. Half mile west of Handel Sask. Handel is west of Biggar on highway #51.

Time: 2.00 pm.

Activities:
Farm Visit
Velvetting - Jerry Haigh
Handling - Rick Alsager
Injection systems - Jerry Haigh
***Nutrition* (Guest speaker Dr. Bob Hudson)**
Feast

The Loerzell family have been farming elk and buffalo for about a year. They have constructed a new handling facility and are keen to share with us their experiences, problems and hopes for the future.

Field day supported in part by the Canada/Saskatchewan ERDA agreement

Saskatchewan Game Farmers Association

FIELD DAY

Ryan & Roberta Clarke's farm, Fairlight, Sask.
(1 mi. S. of Fairlight on #8 and 2 W)

Saturday Sept. 26th. 1.00pm

1987

Farm Visit
Game Farming Regulations - Ron Lind
Reproductive management - Jerry Haigh
Winter feeding - Ryan Clark, Jerry Haigh

Feast- 6.00pm. ($10.00 per plate)

Pre-registration required for feast. (tel 306-646-4974 evenings)

Canadian/Saskatchewan Game Farmers Association
(tentative program)
Joint Scientific Meeting
Swift Current
March 18th/19th 1988

Registration Thursday evening at the Horshoe Lodge 6.30-9.30
Registration at **Composite High School** 7.30-9.00am Fri March 18th.

Morning Session - Friday March 18th. - Composite High School

General
Chairman Wade Hainstock

A Social Perspective on Game farming Howard Paish, Coquitlan, B.C.	8.00-8.20
Animal Welfare and Game Farming Dr. Bob Hudson, Edmonton, Alberta	8.20-8.40
Deer farming in Australia Dr. Tony English, Sydney, Australia	8.40-9.10
Wood Bison and the Waterhen Project Harvey Payne, Manitoba Wildlife Branch	9.10-9.30
New Federal Health of Animals Activities Dr. Rick McLean, Regina, Sask.	9.30-9.50
Coffee - Visit the Exhibits	9.45-10.15

The Business of Game Farming (session #1)
Chairman Don Karakachuk

The State of the Industry - Bison, Elk & Fallow Deer in Canada Judd Bunnage, Edmonton, Alberta	10.15-10.30
Managing for Profit in the Bison Industry Bill Lenton, Miami, Manitoba	10.30-10.50
Growing Antlers for Profit Rick Alsager, Maidstone, Saskatchewan	10.50-11.05
Fallow Deer - A new business venture in Saskatchewan Dr. Ed Marshall, Quesnel, B.C.	11.05-11.20
Promotion of game farming Ryan Clark, Fairlight, Sask.	11.20-11.35
Other sources of profit from game farm animals Wade Hainstock, Hazel Dell, Sask.	11.35-11.55

Sat 19th March

Management on Game Farms
Chairman Rick Alsager

The yearly round in a bison operation Dr.Ken Throlson, New Rockford, N.Dakota	8.00.8.45
Pasture management for maximum production Dr. Bill Cates, Saskatoon, Saskatchewan	8.45-9.15
The yearly round in an elk operation Dr.Jerry Haigh, Saskatoon, Saskatchewan	9.15-10.00
Coffee - Visit the exhibits	10.00-10.30
The yearly round on Australian fallow farms Dr.Tony English, Sydney, Australia	10.30-11.15
Planning a herd health scheme for game farmers Dr.Judit Smits, Saskatoon, Saskatchewan	11.15-11.45

Lunch - on your own

Farm Visit

At 1.00 pm buses will be available for a trip to the **Sawki** Bison Ranch near Swift Current

Hotel information

Main conference hotel & registration centre
Horshoe Lodge,
Box 1206 Swift Current,
S9H 3X4
tel 306-773-4643

Adjacent motels/hotels

Imperial 400 Motel
1150 Begg St.,
Swift Current
S9H 3X6
tel 306-773-2033

Travelodge,
N. Service Rd.,
Hwy 8, Swift Current,
S9H 3X6
tel 306-773-3101

Westwind Motel,
N. Service Rd.,
155 Begg St. N.W.,
Swift Current,
S9H 3S8
tel 306-773-7295

Saskatchewan Game Farmers Association

Field Day

Friday 15th July 1988

at the home of Rick & Suzanne Alsager
Maidstone,
Saskatchewan
(3 miles south of town)

Program:-

1.00 pm
Farm Visit guided by Rick

3.30 Coffee

4.15 Guest Lecture Dr. John Fletcher*
Reedie Hill Deer Farm, Auchtermuchty, Scotland.

Deer Farming - Ancient & Modern

5.15 Panel Group Discussion

6.00 Pot Luck barbeque.

Soft drinks & buns will be provided by the association. Barbeque pits will be available. Bring your own salads, utensils & so forth.

Start your weekend early. Come to the filed day and then go on to a weekend of relaxation - fishing, shopping or whatever suits your fancy.

* Dr. Fletcher is a leading figure in the deer farming scene world-wide. He and his wife operate a deer farm near Edinburgh as well as being involved in an operation in southern England. He regularly consults on deer farming matters in Europe and has made several trips to New Zealand. He will be lecturing in Saskatoon prior to the field day. His trip is sponsored by the Canada/Saskatchewan ERDA agreement.

Joint Canadian/Saskatchewan Game Farmers Association Annual Meeting 1989
Wayside Inn, Lloydminster March 30th, 31st, and April 1st 1989

Friday 31st March

Management Matters. Chairman, Ed Hudson

8.30-9.15	The New Zealand Imports - How have they fared	Tony Pearse
9.15-10.00	The Wood Bison Story	Corm Gates
10.00-10.30	Coffee Break - Sponsored by Sask. Wheatpool Livestock Division	
10.30-11.15	Fallow Deer Management	Jerry Haigh
11.15-12.00	Management problems with NZ wapiti (elk)	Tony Pearse
12.00-1.15	Lunch - on your own	
	More management. Chairman Jerry Haigh	
1.15-1.45	Deer farming down under	Judit Smits
1.45-2.30	Antlers: form & function	Tony Bubenik
2.30-3.00	Federal H.of A. issues	Rick McLean
3.00-3.30	Coffee Break - Sponsored by Tanka Research	
3.30-4.00	Saskatchewan disease report	Judit Smits
4.00-4.30	Sask. Game Farming Technical Advisory Committee	Ron Lind
4.30-5.00	Feeding for antler growth	Tony Bubenik
6.00	Reception	
7.00	**Banquet, After dinner speaker:- The Honourable Joan Duncan** Minister of Economic Development & Tourism	

Auction sale - Courtesy of Moore's Auctions

Sat 1st April

Marketing - Goals for the future. Chairman Ryan Clark

8.30-9.00	Tanka Research Marketing Survey	Mary Degelman
9.00-9.30	Marketing strategy panel	Dan Patten, Mary Degelman
		Len Schamerhorn
9.45-10.15	Forward development	Bill Norton
10.15-10.45	Coffee - Sponsored by Moore's Auctioneering Ltd.	
10.45-11.00	Preparing your farm & animal for a sale	Norm Moore
11.00-11.30	Live animal sales panel	Norm Moore, Don Allewell
11.30-12.15	Antlers, buyers guide, panel	John Choi , Owen McGuire
		Rick Alsager

Lunch on your own 12.15

1.15-1.45	Canadian game Farmers Assn. Annual Meeting
1.45	Sask Game Farmers Assn AGM

Wednesday June 14 1989

VETERINARIANS IN THE GAME FARM INDUSTRY

6.00-7.30am	Farm visit ± velvetting demonstration	Marimba farm
7.30-8.45	Faculty Pancake Breakfast	

General Session
Chair - Judit Smits

9.00-9.30	Veterinary Services to a New Industry	Peter Wilson
9.30-10.00	Alternative ungulate species	Jerry Haigh
10.00-10.45	Herd Health & Productivity	Peter Wilson

10.45-11.00 Refreshment break

Disease problems
Chair - Ed Doornenbal

11.00-11.30	Mineral Imbalances on New Zealand Deer Farms	Peter Wilson
11.30-12.00	Malignant Catarrhal Fever	Judit Smits

12.00-1.15 Lunch

Health & Diseases
Chair - Jerry Haigh

1.15-1.45	Disease Survey of Western Canadian Game Farms	Judit Smits
1.45-2.00	Mule Deer Experiences	Doug Surine
2.00-2.15	Polioencephalomalacia in Fallow Deer	Judit Smits
2.15-2.30	Rotavirus Scours in Bison Calves	Ed Doornenbal
2.30-2.45	Dystocia in 11 of 48 Elk Cows	Ed Doornenbal
2.45-3.15	Practitioners Panel	Afternoon Speakers

SASKATCHEWAN GAME FARMERS ASSOCIATION

FIELD DAY & OPEN HOUSE

JULY 15 AND 16, 1989

SATURDAY, JULY 15: FIELD DAY - ANTLER CREEK GAME FARM
KERRI & RANDY SMULAN
WAWOTA, SASK. PHONE: 739-2518

AGENDA:

9:00 - 12:00	OPEN HOUSE
12:00 - 2:00	TOUR OF FACILITIES
2:00 - 4:00	SPEAKERS -INTRODUCTION TO GAME FARMING -GAME ANIMAL DISEASES -GAME FARMING REGULATIONS -SASK/CANADA AGRICULTURE -HANDLING & ANTLER VELVET -AGRICULTURE DIVERSIFICATION & FINANCE
4:00 - 5:30	QUESTION & ANSWER SESSION
5:30 - 8:00	BARBEQUE BANQUET OF VENISON COST: $10.00 PER PERSON $25.00 PER FAMILY
8:00	GENERAL MEETING - KENOSEE LAKE

SUNDAY, JULY 16: OPEN HOUSE - 12:00 - 6:00 P.M. HOSTED BY:

ANTLER CREEK GAME FARM :- Elk, Big Horn Sheep & Fallow Deer
RANDY & KERRI SMULAN
WAWOTA, SASK. PHONE: 739-2518
Located: 1-1/2 mi. S. On Cannington Lake Road off Hwy #48

CANCADE GAME FARM :- Elk
LLOYD & MELANIE CANCADE
KENNEDY, SASK. PHONE: 538-2230 or 538-4511
Located: From Kennedy; 4 mi. W. & 1 mi. S.

WAYNE & GWEN HIRTLE :- Elk
WAWOTA, SASK. PHONE: 739-2675
Located: Off Hwy #48 on Cannington Lake Road; 6 mi. S, 1 mi. E, & 3-3/4 mi. S

R.J.GAME FARM :-Elk, Caribou & minature horses
RYAN & ROBERTA CLARK
FAIRLIGHT, SASK. PHONE: 646-4974
Located: From Fairlight; 1 mi. S. & 2 mi. W.

PARKLAND GAME FARM :-Elk, Caribou & Antelope
DON & MAUREEN KARAKACHUK
YORKTON, SASK. PHONE: 782-0420
Located: From Yorkton, Jct. 9 & 10 Hwys.; 6 mi. N (East Ave.) & 2 mi. W

ACCOMMODATION ON YOUR OWN: SUGGESTIONS WITHIN 40 KILOMETRE RANGE:-
KENOSEE LAKE, WAWOTA, CARLYLE, MOOSOMIN, REDVERS

CAMPING AVAILABLE AT R.J. GAME FARM, FAIRLIGHT, PHONE 646-4974 (NO water/power)

THE WESTERN COLLEGE OF VETERINARY MEDICINE
University of Saskatchewan
Saskatoon, Saskatchewan

PRESENTS A

SHORT COURSE ON GAME FARMING

THURSDAY, JULY 14, 1988

SPEAKERS

DR. JOHN FLETCHER, PhD., MRCVS
Reedie Hill Deer Farm
Auchtermuchy
Fife
Scotland

DR. JERRY HAIGH, BVMS; MSc.
Department of Herd Medicine and
Theriogenology
Western College of Vet. Medicine
Saskatoon, Canada

PROGRAM

Room 2115, Western College of Veterinary Medicine

8:00 a.m.	Registration	
8:30 a.m.	The World Scene	Fletcher
9:00 am.	Principles of Handling-	
	1. Mustering	Haigh
9:15 a.m.	2. Yard and Houses	Fletcher
9:35 a.m.	3. Elk	Haigh
9:45 a.m.	4. Transportation	Fletcher
10:00 a.m.	Refreshment Break	
10:20 a.m.	Drugs - Sedation, Anesthesia, Equipment, Human Risks	Haigh
11:00 a.m.	Reproductive Management	Fletcher
11:45 a.m.	Discussion	
12:00 noon	LUNCH - Faculty Lounge (3105)	
1:00 p.m.	The Herd Health Approach	Haigh
1:45 p.m.	Antlers - Physiology and Function	Fletcher
2:30 p.m.	Refreshment Break	
2:45 p.m.	Velvetting (video)	Haigh
3:00 p.m.	Case Reports	
3:45 p.m.	The Canadian Scene	Haigh
4:30 p.m.	Short Course Ends	
5:30 p.m.	Game Farm Visit and BISON BARBECUE	

(see other side)

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UNIVERSITY OF SASKATCHEWAN

WESTERN COLLEGE OF VETERINARY MEDICINE
DEPARTMENT OF HERD MEDICINE AND THERIOGENOLOGY

SASKATOON, CANADA
S7N 0W0
(306) 966-7145

FILE _____

Final report - Game farming Provision of Information
ERDA contract 2.1-9
Period Jan 1 - June 30 1989

This report is an outline of further activities carried out under the above contract. Previous reports have outlined activities in 1987 & 88.

Publications

Disease considerations	GF-S-3-01
Brain & Muscle worms	GF-S-2-01
Tuberculosis	GF-S-4-01
Necrobacillosis	GF-S-5-01

As reported on Dec 30 1988 the pamphlet entitled "Rompun Misuse" has been circulated throughout the veterinary Associations of Canada. I enclose a copy of a slightly altered version prepared for the scientific journal of the Canadian Veterinary Association. This same material was abstracted and published in a newsletter of the Association of Bovine Practitioners.

In addition five previously published pamphlets were reprinted (750 copies each). Two of these were revised to include updated information.

The mailing list has swollen to almost a thousand names, and most of the agricultural extension offices in Saskatchewan receive more than one copy of each issue. About 1200 copies are sent each time.

Workshops & Meetings

The Annual General Meeting of the SGFA was held in Lloydminster on March 30th & 31st & April 1st 1989. Over 150 people registered. The visiting speakers were from New Zealand, as well as Ontario and the Northwest Territories. Mr. Tony Pearse from the Invermay Agricultural Research Centre addressed the delegates on the subjects of deer farming in New Zealand, and on the management of wapiti. Dr. Cormack Gates talked about developments in the wood bison story, and Dr. Tony Bubenik discussed antlers, their role in the social life of deer, and their evolution.. A copy of the program is attached.

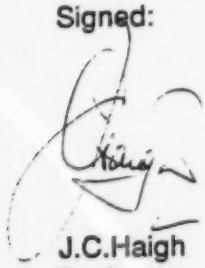
On the 14th June 1989 a one day seminar for veterinarians was held in Saskatoon. The guest speaker was Dr. Peter Wilson of Massey Univertsity, an internationally know veterinarian and researcher. Forty-five veterinarians from as far away as Ontario and Vancouver Island attended the session. A copy of the program is attached.

The overall reaction was favourable and moves are already underway to arrange a follow-up for next year.

Accounts

The Office of research services has provided the enclosed statements of accounts for the 1988 period.

Signed:



J.C.Haigh
Professor

cc Office of Research Services U of S, Dr. Rhodes, Dean Hamilton.

GAME FARMING PRACTICE

NOTES FOR THE GAME FARMING INDUSTRY

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University of Saskatchewan

Introduction

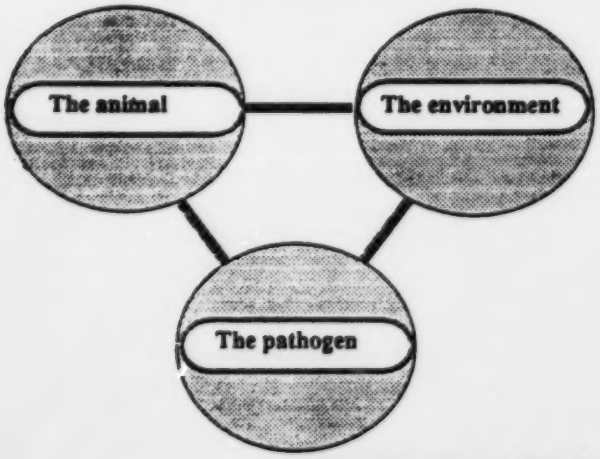
The human understanding of disease has changed and evolved a great deal over the centuries. The role of evil spirits, humors, foul air and more recently the concept that a single organism can, all alone, cause disease have been steps in the thought processes.

Modern thought, at least in the western world, leans to a more holistic view of things. While there is no doubt that a pathogenic organism is a vital component in the infectious disease process, the role of the environment and of the animal itself play just as important a part. This concept is illustrated in the figure below, which depicts the three elements as separate circles of equal size, all in balance. As long as that balance is maintained the animal remains in normal health. Imbalance will often upset the apple cart. This pamphlet is designed to illustrate, with a few examples in each case, how some of these imbalances can occur in game farm animals.

The Animal

There are several ways in which differences amongst animals may alter their susceptibility to disease agents. These are listed in the next column.

Some species of game farm animal are more resistant to certain diseases than others. An example is the varying susceptibility of deer species to malignant catarrhal fever. It seems that fallow deer are entirely resistant, on the other hand white-tailed deer are very susceptible.



Animal factors that effect disease susceptibility

Species	**Immune state**
Age	**Nutrition**
Sex	**Stress**

Age: Copper deficiency in wapiti is more a disease of young adults than juveniles. Bacterial scours occur most often in calves.

Sex: Males are most susceptible to winter death syndrome.

Immune state: Calves that have not had colostrum are more susceptible to a variety of infectious diseases. Vaccination, particularly against Clostridial disease or Leptospirosis may protect treated animals.

Nutrition: Malnutrition is at the root of many disease problems on game farms. Overfatness can lead to dystocia in calving females.

Stress: On the individual animal basis, an animal accustomed to the farm, and trained to the handling system is less likely to be susceptible to capture myopathy than a recently introduced one.

The Environment

The farmer can do little about the global environment, but can ensure that the animals on farm are maintained under the best possible conditions. Some factors that the farmer can control are tabulated above.

Crowding: If calves are maintained with adults, and do not have access to feed bunkers they may not grow as well as they should, and this will have an adverse effect on their

Publication supported by the Canada/Saskatchewan ERDA agreement

Environmental factors that effect disease susceptibility

Crowding	Sanitation
Season	Safe handling facilities
Stocking density	Species interaction

productivity. Severe crowding of unsegregated animals in handling facilities may lead to trampling. Crowding males and females during the rut could have disastrous results.

Sanitation: Good sanitation is an integral part of any farming operation. Game farm species are no less susceptible to problems that arise in unsanitary conditions than any other animal.

Season: On the game farm in Canada the most obvious example of environmental change is the seasons. Winter takes its toll on all animals. It can have a profound effect upon game farm species. The fact that members of the deer family and bison have evolved efficient strategies to deal with winter is of considerable advantage to the game farmer. Nonetheless, the animals must be properly fed. In this case nutrition and season are considered together.

If the hind's nutrition falls short of the targets set in the wapiti nutrition pamphlet (GF-N-3), especially in summer, there will be a cascade of problems that could be classed as a production disease. The milk yield will drop. This will effect the growth of the calf. The calf in turn will enter winter underweight, with reduced disease resistance; it may never catch up. The hind may not reach an adequate weight to be fertile during the rut. Even if she is fertile, her undernourished condition may reduce her own disease resistance or diminish the chances for survival for the fetus.

The most important time for feeding a stag is just after the end of the rut. He may have lost as much as 90 kg in the space of 8 weeks. This is about 20% of his bodyweight. If he is not fed adequate rations during the month of November he will enter the worst part of the winter in such poor condition that he will be susceptible to almost any disease agent that is in his environment. In New Zealand a term has been coined to describe the "disease" that overtakes these stags. It is generally known as **Winter Death Syndrome**. Proper feeding and shelter at the right time will usually prevent it.

Safe handling facilities: There is no doubt that a major cause of trauma on game farms is the use of poorly designed handling facilities.

Stocking density: Animals in overcrowded conditions, even if fed adequately, may be exposed to disease agents more readily than they should. This particularly applies to build up of pathogens such as coccidia and intestinal worms on overcrowded pasture.

Species interaction: Many game farmers are running more than one species on the property. This may pose a problem, particularly if animals are in the same paddock and are too crowded. A recent case involved the death of three white-tailed deer kept with a single wapiti stag during the rut.

The Pathogen

The Webster's dictionary definition of the word pathogen reads "A specific cause of a disease". It would be a mistake to consider pathogens purely in terms of infectious agents. While viruses, bacteria, fungi, and various types of parasites are commonly thought of as pathogens, agents such as toxins, and nutrients that are fed to excess, or are deficient, can also cause problems. Even a traumatic event could be classed in this category.

Some pathogens will cause a disease whenever they contact a susceptible animal. An example would be the virus of foot-and mouth disease. Other pathogens are present all of the time but only cause disease when the host's environmental factors are changed. Pathogens also undergo changes in their nature. An animal may have developed immunity or resistance to a particular strain of a pathogen and be quite susceptible to a new strain. An example of this would be the influenza virus in humans.

It would also be a mistake to isolate a particular pathogen and categorically state that it is the cause of a particular disease. Obviously in the case of something as specific as meningeal worm in moose, one would be correct. On the other hand there are a number of disease conditions that involve the interplay of more than one pathogen. An example of this would be the lungworm pneumonia complex of Bighorn Sheep. This disease, which has been incriminated in massive die-offs of whole herds of wild sheep, has a complex origin that may derive from environmental stress, malnutrition, lungworms, bacteria and viruses.

Wapiti stag with a broken leg.
Caught in a gate in poorly designed facilities

Types of disease

It has proved necessary over the centuries to evolve a set of descriptions for the classification of different degrees of disease severity and manifestation. One such classification is the use of the terms **peracute, acute,** and **chronic.**

Some causes of peracute death

Anthrax
Malignant catarrhal fever
Gunshot
Trauma (eg broken neck)
Lightning strike
Poisoning

A **peracute** disease is one that strikes so quickly that often no clinical symptoms are seen before the animal is dead. Anthrax, which is seen in almost any type of mammal, is such a disease. A disease report of a case of anthrax may simply be confined to a statement such as "found dead in paddock". Of course other catastrophic events such as lightning strike or poisoning would have the same effect.

An **acute** disease is one that strikes very rapidly, and is of short duration. The animal may go from apparently healthy to very sick in a few hours or a day or two. Many forms of infectious disease such as malignant catarrhal fever and shipping fever usually show up in this form.

The term **chronic disease** is used to describe a situation in which the animal is effected for an extended period. This could be days, weeks or even months or years. Many nutritional deficiencies fall into this category. Other diseases of concern to the game farmer that could fit into this class could be some forms of tuberculosis, brucellosis, and parasite infestations.

Porcupine quills can be a problem.
In a bison (above) and a wapiti (r)

The implications of disease for any herd or individual that has a problem vary quite markedly. There is a tendency to think that the peracute or acute form of the disease is the most important. What may be forgotten is that a chronic situation, in which herd productivity is depressed, may have a more profound effect upon the profitability of the operation. This can go as far as the scene in which a chronically sick animal can actually cost a farmer more than one which dies early on in the course of its illness. A chronically sick herd, suffering from a deficiency that depresses fertility, would be a very expensive proposition.

Classification

For the game farmer it is possible to classify the types of disease. Some diseases will fit into more than one category. A very broad classification is used below.

Types of Disease

Class	*Example*
Bad luck	Porcupine Quill Injury
Bad management	Late Calving
Infectious disease	Lungworm
Non-infectious disease	Copper deficiency

Summary

There is no magic formula to the prevention of disease in game farm animals. There is no substitute for good management, which comprises good nutrition, good handling and "stockmanship". The most important diseases of deer species are similar in New Zealand, the United Kingdom and Australia . The picture that is beginning to emerge in Canada has, not surprisingly, the same pattern. The common and important ones are shown in the table overleaf.

It is probably appropriate to paraphrase Dr. Peter Wilson of Massey University who wrote in a recent issue of "The Deer Farmer" .... A multitude of diseases effect deer. The farm environment provides the optimum opportunity for diseases to become well established in an animal population, both by intensive management on a given property and by the high degree of mobility of *game farm animals* * as they are traded....

* *My italics*

Common diseases of deer species on game farms
Based on reports from New Zealand, Australia U.K. & Canada

Agent	Infectious disease	Comment
Virus	M.C.F.	No records in fallow
Bacterial	Tuberculosis	Not in Canada
	Brucellosis	Not in Canada
	Yersiniosis	
	Clostridia	Enterotoxemia
		Black-leg
	Leptospirosis	
	Necrobacillosis	Wild deer at feedstacks
Parasitic	Lungworm	
	Lice	
	Ticks winter tick *(Dermacentor albipictus)*	

Agent	Non-infectious diseases	Comment
Management	Trauma	Antlered males, Poor facilities
	Capture myopathy	Poor handling
	Digestive, eg	Grain overload
		Rapid diet change
	Neonatal scour	Lack of hygeine
Copper	Enzootic ataxia	
Overfeeding	Dystocia	Esp. in wapiti (not in fallow)
Underfeeding	Winter death syndrome	
	Non-viable young	Fallow < 3kg; Wapiti < 11kg

There are a few texts that deal in considerable detail with disease in game farm animals. These are described here together with information on their sources.

Management and Diseases of Deer
A Handbook for the Veterinary Surgeon
Edited By T.L.Alexander
ISBN 0 9510286 0 4 Price £ 15.00 in U.K

As the editor states in his preface, the book is primarily addressed to the veterinary surgeon in the United Kingdom, but there is no doubt that it has an important role to play for any veterinarian anywhere who is dealing with deer species.

Sixteen authors have contributed a series of short chapters that cover both managment and diseases of deer. There is also a set of appendices that give useful factual data covering reproduction, nutritional requirements, biochemical parameters, blood composition, physiologic values, anesthesia and identification. These data may be the most comprehensive gathered inside one set of covers anywhere for deer species.

For further information write to:- The Veterinary Deer Society, c/o Britsih Veterinary Association, 7 Mansfield St., London W1M 0AT ENGLAND.

Refresher Course for Veterinarians
Proceeding # 72, University of Sydney, Australia
ISBN 0 909973 18 0 Enquiries to :- T.G. Hungerford, P.O.BOX A5661, Sydney South, 2000
SYDNEY NSW AUSTRALIA

This 772 page volume provides an extensive coverage of veterinary aspects of deer farming in Australia and New Zealand. There is a detailed index which has both subject and author listings, although the fact that these are mixed in the same index tends to be a little confusing.

Many chapters are extremely detailed and provide the reader with an in-depth look at a particular aspect of the deer farming industry. For the veterinarian there is a wealth of information, but frequent reference to the index is vital if one is to avoid becoming quite frustrated. Some of this frustration arises because the book is a compilation of proceedings of two different meetings, and no attempt has been made to edit content and avoid duplication.

As with many proceedings the contents have been prepared from "as ready" copy and so there is some variability in type-setting. There also appears to be little or no flow or structure to the order of the chapters, or the order in which the papers are presented.

Diseases of Deer
Dr. A.W.English. **Vade Mecum** series for domestic animals. Enquiries as per Refresher course above. A$ 42.00 + post.

This slim volume covers, more or less in note form, the "Therapy & Control measures necessary to deal with the problems most likely to be encountered with captive deer". The various species of deer in Australia are described and then the author has alphabetically arranged and cross indexed, diseases from abdominal adhesions to zinc deficiency and drugs from acetic acid to Zoaquin.

A useful pocket guide.

I should like to thank Drs F. Leighton & C. Rhodes for comments on early drafts of this pamphlet

GAME FARMING PRACTICE

NOTES FOR THE GAME FARMING INDUSTRY

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Necrobacillosis

Introduction

Necrobacillosis is also known as necrotic stomatitis, foot rot, calf diphtheria, and lumpy jaw. These names are an indication of the fact that the agent that causes this disease can affect animals in a number of different ways.

The agent

The bacterium that causes this disease is called *Fusibacterium necrophorum*. It is often found in association with other bacteria, and infection almost always occurs in animals that are debilitated or stressed in some way. This bacterium is a part of the normal intestinal flora, so that it is abundant in areas contaminated with feces.

Species affected

Individual cases have been reported in a wide variety of animals, but the captive species most often affected are ungulates. The most commonly affected game farm animals are mule and white-tailed deer, but moose and wapiti have been reported with the disease. Pronghorn antelope, which are not usually farmed, are also susceptible. Kangaroos and wallabys are very susceptible to this agent, and major die-offs have occurred in zoos, as well as in the wild. In cases of foot rot in cattle, which usually occurs in muddy conditions, this organism is often found.

Mode of infection

F. necrophorum occurs world-wide. It is commonly found in the intestine of animals, causing no problems. It is shed in feces and remains viable in the soil for a considerable time. If animals are healthy, and not overcrowded, no cases of clinical disease may occur. If the balance outlined in the "Disease considerations" pamphlet (GF-S-3) is disturbed, clinical disease may ensue. Some such imbalances are outlined below:-

Overcrowding
Inadequate food supply
Sharp objects in feed
Injuries to feet
Reduced resistance

The bacterium is not able to penetrate intact skin, but will readily penetrate if the skin is damaged. Minor injuries to the mucous membranes of the mouth allow ready entry (it is this mechanism that is thought to create problems in marsupials). Old deer, with sharp or unevenly worn teeth, and deteriorating gums, are very susceptible, as are young animals in which the teeth are erupting.

Fig 1. Tongue and lymph nodes of deer afected with necrobacillosis. Note abscess under tongue (arrow) and enlarged nodes.

In situations where animals are subjected to sudden changes in feed, or develop some degree of grain overload, the changes in the chemistry of the rumen can set up conditions that allow this organism to become established. Once into the animal's system the bacterium can grow and spread to other organs. Lesions have been found in most of the major organs.

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The disease has been recognised by Dr. Gary Wobeser at the Western College of Veterinary Medicine as an important problem of wild deer and pronghorns at feed stacks in winter. While it does not spread from deer to deer, the overcrowding, malnutrition, and sharp or coarse feed all contribute. It is likely that reduced resistance also plays a part.

Clinical signs

Signs vary according to the location of the lesions. Foot rot will cause lameness. Lesions in the mouth will create a swollen jaw or face, and often cause the further problems as the animal goes off feed. Animals with mouth lesions, or more generalized infection, usually appear to be in very poor condition. The hair coat is often rough. Sick individuals are usually depressed.

Pathology

In his "Handbook of Diseases of Saskatchewan Wildlife" Dr. Wobeser has described the pathology of this disease as follows:-

"Lesions are most common in the oral cavity, with destruction of tissue in the tongue, about the teeth and/or on the roof of the mouth. The dead tissue is soft, yellow-white and very friable; and there are often plant awns or twigs embedded in the sites. Similar necrotic areas may be found in the forestomachs, liver or larynx. There may also be large areas of dead tissue in the lungs of some animals. In cases of footrot the foot is swollen, particularly just above the claws, and there may be cracking of the skin in this area or between the claws, with seepage of foul-smelling fluid from this cracked skin."

Treatment

If treatment is to be attempted it is imperative that an early diagnosis be made. Once generalized lesions have developed treatment is usually futile. Of all the manifestations of this disease, foot-rot is probably the most amenable to treatment.

A combination of things is required. First the animal must be restrained in such a way that the foot can be thoroughly examined and cleaned. this will probably mean that sedation or immobilization is needed. Once the lesions have been examined, and a bacterial culture taken, the lesion should be thoroughly cleansed using water, preferably without any disinfectant other than tamed iodine. Strong disinfectants such as Dettol are usually mixed up much too concentrated and will cause further damage.

For most game farm species it will be impractical to return every day, or even twice a day, to treat the problem, as one might for a dairy cow. If a drop floor chute is available, and the affected foot can be soaked in a solution of warm water and epsom salts for 20-30 minutes daily, recovery will be enhanced. An alternative is to apply a dressing, covered with an antibacterial ointment such as Furacin™, and then wrap the foot in good bandaging.

Some sort of antibiotic therapy is indicated, and it would be wise to be sure of vaccination status against tetanus and clostridial diseases.

Just as important as the first aid is an examination of the conditions under which the problem developed. The animal may be living in conditions that are unhygienic or too crowded. Animals in a group that are low in the dominance heirachy may not be getting access to sufficient food, or may be subjected to constant harassment. These situations must be corrected at the same time as the medical treatments are carried out.

Fig 2. Foot of moose calf affectd with necrobacillosis. Note swelling and separation of hoof at coronet.

Bibliography: Gary A. Wobeser. Handbook of Diseases of Saskatchewan Wildlife. 1985. . Sask. Parks & Renewable Resources.

Photo credits. Gary Wobeser.

Thanks also to Gary Wobeser for comments on the first draft of this pamphlet.

GAME FARMING PRACTICE

NOTES FOR THE GAME FARMING INDUSTRY

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Tuberculosis

Introduction

Of all the infectious diseases reported in game farm animals none has generated more articles than the single subject of tuberculosis (TB). The literature in trade magazines and scientific journals is replete with the subject. The reasons are numerous. There is probably no single disease associated with animals, and meat consumption, that has a greater negative effect upon the marketplace than this one. The association in human minds with long-term hospitalization - usually in some sort of sanatorium - and a probable outcome of death or life-time debility, are part of the story.

For the game farmer perhaps the most important reason to be concerned would be the indirect cost to the entire industry. During a TB outbreak the price of animals falls, there is a reluctance to buy because of disease worries, and public concern may restrict or reduce markets for producers. Trade can be restricted locally, nationally or internationally.

The situation is further complicated by the fact that no satisfactory treatment for animals has been developed, although some have been tried. Testing for infection in an individual animal is an inexact science, and this makes all the more imperative the idea of testing large groups of animals. TB can have an insidious onset and long before the first animal infected shows any signs of sickness the disease can have spread throughout a herd. A major headache for regulating bodies throughout the world is directly related to this phenomenon. If a single TB infected animal is introduced to a previously unexposed herd the disease will very soon start to spread. If, soon after this introduction, any animal on the farm is moved to another location it may carry the disease, even after testing negative, and so disseminate the problem far and wide.

In this pamphlet I plan to describe the disease, discuss testing and quote case reports that indicate the extent of the potential problem to the Canadian game farming industry. We are fortunate that at the moment we do not have any cases of this disease confirmed on a farm anywhere in Canada. The presence of the disease in the wild herd of hybrid bison in Wood Buffalo National Park, and the potential for its introduction through the movement of infected animals from other countries, especially with the vigorous trade of animals currently being conducted, make it essential that continued vigilance be maintained to ensure that we do not introduce this disease into our herds.

Fig 1. Dead bison in Wood Buffalo National Park

The organism

Tuberculosis in animals is caused by one of a genus of bacteria that share several characteristics. These include a tendency to be resistant to

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animal body defenses, and a relationship with the animal in which chronic disease, and the development of abscess-like granulomas around the bacterium, occur. The name of the genus is *Mycobacterium*.. There are three important members, at least for the game farmer. ***M. tuberculosis***, which is the most common cause of TB in humans, is seldom a problem in other animals, except captive primates. ***M. bovis***, as its name implies, is the important organism causing TB in cattle. It is this bacterium that is most often incriminated in outbreaks of tuberculosis in bison and deer species. ***M. avium*** is the agent that causes TB in birds, it can also infect or sensitize mammals and has been the cause of confusion in testing. It is considered to be an important part of the TB problem in British deer. The infection is seldom as severe as that caused by the human or bovine strain, but if a patient's immune system is depressed *M. avium* can cause very severe disease, and it has been reported that treatment of humans with drugs that are effective for *M. tuberculosis* is ineffective against *M. avium*..

There are a substantial number of other members of the Mycobacterium family that cause disease. Fish have their own special species, and several others have been incriminated in clinical cases. One of the most important causing disease to livestock is the agent that causes Johne's disease, which will be discussed at another time.

Species

All of the species currently on game farms in Canada are susceptible to TB. There have been cases reported in North America in bison, wapiti and fallow deer, all within the last few years.

Spread

There are several ways in which TB can be spread from animal to animal. In deer the commonest is via the mouth. This can occur when animals are grazing and pick up bacteria that have been excreted from the tonsils of an infected animal. There is an unusual and interesting component to this type of transmission in New Zealand. The brush-tailed possum, a marsupial imported from Australia, can transmit M. bovis directly onto pasture from draining abscesses. In some parts of the country this presents a continuing and almost uncontrollable source of infection for livestock, including deer. Draining abscesses from any species would have the same effect.

In bison infection is most often sited in lymph nodes of the head and in the thorax. Transmission probably occurs by coughing. Feces could also be a source of infection, either due to the presence of lesions in the gut, or after organisms are coughed up and swallowed.

Infection sites

Infection in deer species is usually restricted to lymph nodes in the head, abdomen, or thorax. In a recent outbreak in ranched bison most of the lesions were in the lymph nodes close to the lungs. The same distribution of lesions was seen by Dr. Stacy Tessaro during his study of the bison herd in Wood Buffalo National Park. Both deer and bison can also develop a generalized infection, with lesions in many parts of the body. The lymph nodes are usually enlarged and hard. They may be almost completely replaced by granulomas. If the nodes are near the skin they may rupture and drain to the outside.

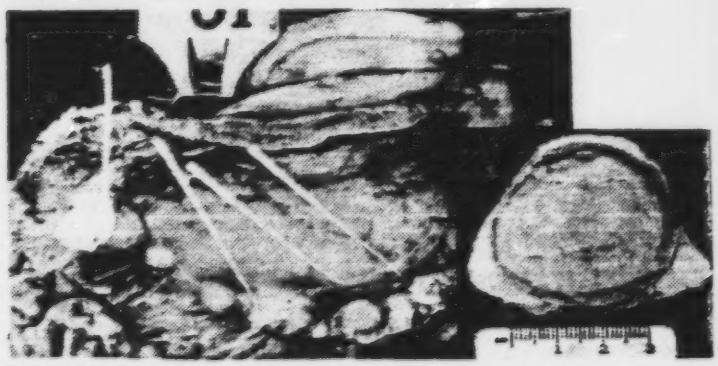

Fig 2. TB granulomas in lymph nodes of a deer (arrows). Inset, enlarged tuberculous node.

Fig 3. Normal (l) and TB damaged lung (bison)

In the lungs these granulomas often have a chalky appearance. If the infection spreads to the liver it may appear to be covered in white spots.

Fig 4. White spots (TB granulomas) on cut surface of bison liver

Clinical signs

It is only the most severely affected animals that show any signs of generalized sickness with this disease. This is because the bacterium may be limited to only a few lymph nodes. The other manifestation may be a thick creamy yellow-green pus draining from abscesses under the skin.

Animals that do show signs often lose weight rapidly and soon become emaciated. Sudden death can occur in seemingly healthy deer.

Control

Tuberculosis is an exceedingly difficult disease to control. The nature of the infection, its method of spread, and the resistant nature of the bacterium all play a role in this. In livestock industries world-wide the only effective method has been testing and slaughter. Even then the method has failed in some areas. After many decades of testing bovine tuberculosis is still a problem in the Republic of Ireland. Testing relies upon a good method of diagnosis.

Diagnosis

The most reliable indication of this disease is a thorough post-mortem examination. This is of little consolation to the producer who needs to test farm animals.

The main problem is that no test yet devised is 100% effective in detecting the infected live animal. The sensitivity of the test is the proportion of infected animals that actually test positive.

Unfortunately, even the best tests can give a false reading in the other direction; uninfected animals may show a positive test. This is an indication of how specific a test may be. If only one healthy animal in a hundred gives a false positive the test is 99% specific.

The validity of any test is calculated by dividing the number of truly positive results by the total positives (which of course includes all the false positives as well).

The test that has been adopted world-wide, and is in use in Canada, is the intradermal or skin test. If an animal is infected, a delayed allergic type reaction occurs when an extract of the bacterium is injected into the skin. This causes a detectable swelling at the injection site which usually takes 72 hours to develop. Good results are only obtained if the hair is carefully clipped over the mid region of the neck before the injection is given.

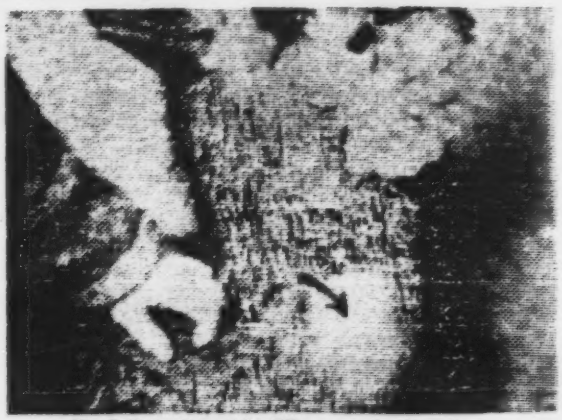

Fig 5. Hair clipped for TB test on deer's neck

Results from New Zealand have indicated that the skin test for red deer may have a 90% sensitivity. A similar figure has been suggested for the intradermal test in bison in the USA. For deer the test appears to be 99% specific.

This test is a good method of detection if there is a high level of infection in a herd. Virtually all the infected animals will react, and the few that give a false positive are considered a reasonable sacrifice.

It is when the infection rate is very low that intradermal testing becomes a problem. Validity declines as the infection rate drops. An indication of the testing numbers is provided overleaf.

Photo credits:- Figs 1,2(inset) & 3,4. S.Tessaro. Fig 2. N.Beatson. Fig 5 J.Haigh

Tuberculin testing of 10,000 animals will give the following results
Assuming that sensitivity is 90% and the test is 99% specific

If 25% of the animals are infected

25% 0f 10,000 = 2,500 animals infected
90% of these show positive = 2250
1% of all animals show false positive = 100
Total animals showing positive = 2350

Validity = 2250 divided by 2350 = 96%

If only 1 animal in 100 is infected

1% of 10,000 = 100 animals infected
90% of these show positive = 90
1% show false positive = 100
Total animals that show positive = 190

Validity = 90 divided by 190 = 47%

I would emphasize that we may not have any infection at all on Canadian game farm animals at present. The figures show how difficult it would be to control things if that should change.

The type of result depicted on the right has led to a good deal of dissatisfaction in New Zealand. As can be seen, if infection rate is high the skin test is an excellent tool. Once things are under control and infection rates are low, problems arise. For this reason other tests have been investigated. One of these is an extension to the skin test. Two injection sites are prepared and the reagents for both *M. bovis* and *M. avium* are used at the two sites. Even this is not fool proof and a blood test that has been recently developed is now in use as a back-up to the skin tests.

One obvious problem is that some infected animals can remain undetected.

Perhaps over time the battery of tests described, or a new single test, will enable us to detect all infected animals, and at the same time not needlessly slaughter healthy ones. Until that time we have to hope that current regulations and controls can keep this disease off livestock properties in Canada. We have had some close calls.

The only way that recent outbreaks in bison and wapiti have been successfully dealt with has been a whole herd test and slaughter policy combined with very careful detective work on the history of animal movements from infected herds.

In 1985 Drs. Essey & Stumpf reported an outbreak that occurred in the USA that involved wapiti, bison and deer. By the time it was over, millions of dollars had been spent in control, eradication and compensation.

In the bison outbreak, 115 premises in 24 states and one province were investigated. The outbreak is thought to have started after the purchase by a game farmer of two sick wapiti from a small zoo. These animals died soon afterwards, but not before they had infected other wapiti and thence bison on the same property. Trading soon led to the dissemination of the disease. Control was achieved by rigorous testing. If any animal on a farm was found to test positive the entire herd was slaughtered. In all, 2086 bison were slaughtered. Of these, 98 were reactors, and 1988 were exposed.

The wapiti outbreak, which started at the same location, did not spread quite as far. One herd was destroyed after most of the animals reacted to the skin test. Deer on the same premises were also destroyed after some tested positive. In this outbreak the investigation was confined to 11 states.

These effective, but expensive, measures appear to have brought things under control - at least until the next time.

I should like to thank Dr. Stacy Tessaro for his comments on the first draft of this pamphlet.

GAME FARMING PRACTICE

NOTES FOR THE GAME FARMING INDUSTRY

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Brain & Muscle worms

Of all the parasites that occur in farmed animals there are two that are currently causing more concern than all the rest put together. The two are closely related roundworms of the Protostrongylid family. Their Latin taxonomic names are *Parelaphostrongylus tenuis* and *Elaphostrongylus cervi*. . Neither parasite occurs west of Manitoba, but both have the potential to have serious effects on a few species.

There are many features that the two parasites have in common, as well as a number of ways in which they differ.

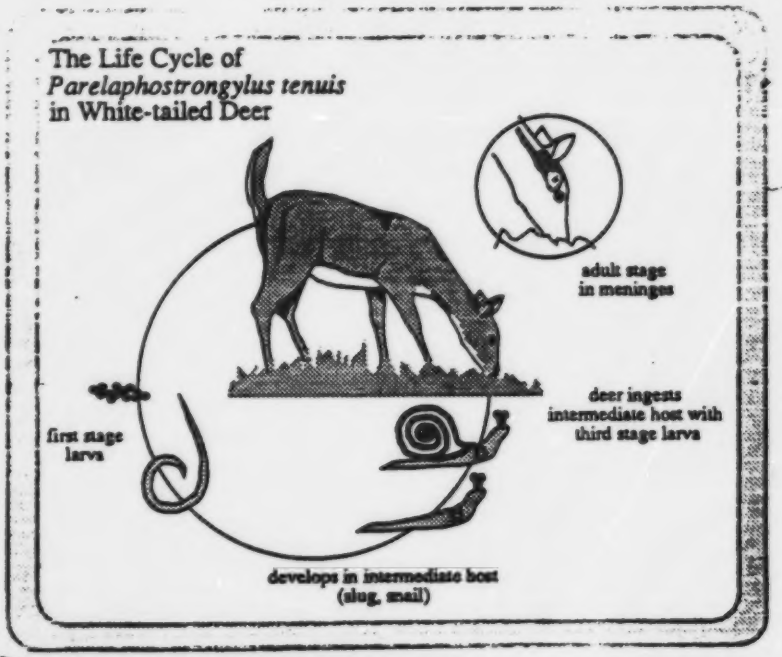
Both parasites have an indirect life cycle. This means that they cannot complete the cycle, or be transmitted from one mammal to another without first going through an intermediate host. The intermediate host, in both cases, can be either a slug or terrestrial snail (gastropod). The cycle is depicted in the adjacent figure.

The adults of both parasites live in tissues of the mammal body other than the gut. Their common names give an indication of the locations. *P. tenuis* is known as the brain or meningeal worm, and *E. cervi* is known as the muscle worm.

Life cycle

Eggs are laid by adult female worms into blood vessels and are swept to the lungs where they hatch into first stage larvae. These larvae pass into the trachea and are coughed up and swallowed, traveling down the gut to be passed in the feces.

On the ground the larvae leave the feces and penetrate the foot of the gastropod. In this environment they mature to a third stage and encyst in the tissues. This development takes about four weeks and they may then persist for the life of the slug or snail. In order for the cycle to be completed the slug or snail must be eaten by a susceptible mammal.



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The idea that a herbivorous mammal would eat a small gastropod is not really as outrageous as it seems. These intermediate hosts are rather small (about 1cm long at most) and occur on vegetation commonly eaten by ruminants. There are also many ruminants that will deliberately seek out small protein meals, such as eggs, chicks, and small rodents.

When a slug or snail is eaten it passes to the stomach of the host where it is digested. The larva is freed and migrates through the wall of the mammal's gut to another site in the body. During this migration the larva, which continues to mature through 4th and 5th stages, can cause varying degrees of damage. The period between infection with a third stage larva and the eventual production of fecal larvae is known as the pre-patent period. With both parasites this is usually about 80-90 days, although longer periods (up to 120 days for *E. cervi* have been reported).

Parelaphostrongylus tenuis.

This parasite was formerly called *Pneumostrongylus tenuis*. In white-tailed deer it lives, usually without causing clinical signs, on the meninges (any of the three membranes surrounding the brain and spinal cord). It can cycle through the slug or snail intermediate host and back into the deer without creating any problems. It is in other species that problems can arise. If another host picks up the gastropod, the larvae of the parasite can migrate from the stomach to the nervous system and create a variety of effects, depending upon which new host is involved.

About the most resistant of the common domestic species to this parasite is the cow. This is obviously fortunate, as the early colonization of eastern North America would have had a profoundly different history had things been otherwise. Among traditional domestic species, the goat appears to be exquisitely sensitive, dying within a few days of infection. The sheep is less susceptible than the goat. Other species, less commonly farmed on this continent, are effected in varying degrees. The llama, a vitally important domestic animal in parts of South America, can develop fatal infections. So too can several of the African antelopes. Experiences at the Front Royal facility of the Smithsonian institute, where much endangered species work is carried out, has shown that white-tailed deer that share pasture with some of these species, will transmit the parasite and cause fatal disease.

Map of North America showing the probable range of P. tenuis. The parasite occurs in the shaded areas wherever white-tailed deer occur. There is no published information on the exact western and northern limits of distribution of the parasite.

This worm has been incriminated in the extinction and/or reduction of both caribou and moose in the eastern half of the North American continent. The classic "moose sickness", during which moose develop a circling disease, waste away, and die, is caused by *P. tenuis*. Caribou appear to be very sensitive. The disappearance of caribou in Nova Scotia, and their failure to reestablish themselves after several translocation attempts has been linked to this parasite.

Of the three species most important to game farming in Western Canada, the wapiti and fallow deer are definitely susceptible, as are mule deer. There does not seem to be any information on the bison.

In species that are affected the parasite causes damage to nervous tissue both in the brain and in the spinal cord. This can create signs all the way from a mild alteration in gait to complete malfunction, collapse and paralysis.

The currently recognised distribution of this parasite is shown on the map on page 2. The slugs and snails that can transmit the disease are present throughout most of the continent, including all four western provinces. An infected white-tailed deer that moved into new range could possibly transmit the disease and set up a new nidus of infection.

The important questions that have to be asked about the life cycle of P. tenuis in species other than the white-tailed deer are:

what effect does it have upon the host ?
and can it be transmitted by that host ?

Early work with young animals showed that wapiti, moose, caribou and mule deer are all susceptible to infection, which is often fatal. Current work to further clarify these questions is being funded by federal and provincial governments in both Saskatchewan and Alberta.

If the parasite creates such a severe disease that the host dies before the parasite matures, then no further transmission can occur. This is in fact a very poor strategy as far as the parasite is concerned. Most really successful parasites have, over the course of time, developed a relationship with their hosts that allows both to thrive, and the parasite to complete its life cycle and move from host to host. *P. tenuis* is no different. It has evolved a peaceful co-existence with white-tailed deer. From the parasite's point of view, the animals in which disease result are abnormal hosts.

Elaphostrongylus cervi.

The geographic distribution of this parasite is fairly well known. It occurs in Scotland, Holland, Czechoslovakia, Norway, Sweden and the western & central USSR. It was introduced into New Zealand with red deer, no doubt with some of the many deer taken to that country by acclimatization societies during the last century. The one place in North America that *E. cervi* does exist is Newfoundland, where it probably arrived with a group of reindeer imported from Norway. More recently it was nearly introduced into Australia from New Zealand and may have been introduced into Maine with caribou from Newfoundland. Inadvertant introduction in the former was prevented by cautious quarantine measures.

In Eurasia, *E. cervi* parasitizes a wide range of cervid hosts. It is known from red deer, maral, sika deer, reindeer, roe deer, and moose. There is one brief report of its occurence in a fallow deer. In these hosts the parasite migrates over the surface of the central nervous system en route to its final destination on and in the muscles of the front and hind limbs.

Clinical disease does occur in some of the above species. It has been known for many years in reindeer, red deer and moose. Animals of these

species, usually less than one year old, show weakness and poor coordination of the hind limbs. Similar signs have been seen in young caribou in Newfoundland. These signs are related to the damage caused during the migration of the parasite on the nervous system. Infected wild moose in Sweden are smaller than uninfected animals of the same age; and infected red deer carcasses in New Zealand are sometimes discarded because of unsightly lesions in muscle.

Diagnosis

Diagnosis of infection with either parasite is most reliably carried out at post-mortem. Even then the parasites can be difficult to find. For *P. tenuis* examination of the entire central nervous system may be required. For *E. cervi* an exhaustive search of the limb muscles may be needed. The other technique that is used is the examination of feces for larvae. The method, known as the Baermann technique, is labour intensive, and therefore more expensive than routine examination for common gut worms. The larvae of the two species and those of other similar, but less dangerous, worms cannot readily be differentiated in feces.

Treatment

For treatment of *P. tenuis* infections a number of different drugs have been tried for the treatment of infected or exposed animals. None has yet been shown clearly to be effective against the adult parasites. Work with Ivermectin (Ivomec™) has shown that a treatment at 0.1 or 0.2 mg/kg subcutaneously very early in the infection is effective against the third stage larvae. By day 10 after infection, when the larvae are already in the spinal cord, treatment is ineffective. Treatment of deer with patent infections creates a transient reduction in larval output. This may be due to the fact that the drug kills first stage larvae in the lungs. By day 28 after treatment larvae again appear in the feces.

Veterinarians faced with sick llamas, that exhibit the same symptoms as other llamas that have died of confirmed *P.tenuis* infection, have been able to arrest the progression of symptoms by administering a combination of drugs. Part of the combination has been Ivomec™ at several times the recommended dose (Foster, personal communication). Further work in this area to establish whether or not effective treatment to eliminate both larvae and adult worms is called for.

I should like to acknowledge the comments and input of Drs. M. Lankester, F. Leighton, W. Samuel and G. Wobeser on an early draft of this pamphlet.

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...blèmes fréquents et pourraient ... vers des faits de pratique ... la crainte de poursuites ... à cacher les problèmes ... et se perfectionnant », et de ... pourraient grandement amé... médecine (2). Les auteurs recom...

... plusieurs défis, mais ... est à notre portée »

... concept de l'ÉP et d'y faire ... fonctionnelles d'ÉP, les pro... la recherche immédiate ... questions précises se rap... patients. Sur ce dernier ... le numéro de mars de la Revue des explications sur les outils informatisés de diagnostic, offerts sur le marché aux vétérinaires.

L'ÉPV affronte plusieurs défis, mais « l'instant de grâce est à notre portée » (2). Nous avons besoin de coordonner les cours et activités des facultés vétérinaires, des associations régionales et provinciales et de l'ACV. Les membres de notre profession sont disséminés, nos ressources en personnel sont limitées et nous ne pouvons nous payer le luxe de reprendre ce que d'autres font.

Grant Maxie

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...ERS TO THE EDITOR

...TRES À LA RÉDACTION

... week must stay

... National Animal Health ... that using the number of ... AHW as a gauge of the par... and the success of AHW is ... some veterinarians will ... will still be promoting ... different ways.

... Abbotsford and I am ... and have seen that the ... have put a tremendous ... ensuring that AHW is a suc... other areas are the same. ... tions tool for our profes... take many years to show ... been advocating no smok... driving for the past 15 years ... the effects of this in our ... that we are such a small pro... it is going to take longer ... the attitudes and values ... We cannot sit back, bury ... do nothing to promote the ... and the importance of ... our future looks bleak. Our ... the view of the public and ... is low.

... improve the status of ... in the future we must ... ness of animal issues and hope that they see fit to improve the status of animals in the eyes of the law and in their own backyard.

As a profession we must be dedicated to AHW for many years to come. It's very, very important.

Yours sincerely,

Josephine M. Banyard D.V.M.

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Misuse of xylazine

Rozovsky, in the June CVJ (1) has described the three legal threats that a veterinarian could face. All three might be brought to bear in cases where drugs, even if they are not under the Narcotic Control Act, are unwisely prescribed.

A recent call from a farmer has prompted me to indicate some of the risks involved with the use of the immobilizing agent xylazine (e.g. Rompun Haver-Lockhart, Etobicoke, Ont). The farmer called because he had failed to sedate a bull elk for antler removal. It turned out that he had used half the recommended dose. He had done this on the advice of another farmer who had little experience with the drug. Furthermore it turned out that he had obtained his supply of Rompun from a third farmer. There are instances of non-veterinary individuals who own darting guns and

make a practice of catching runaway stock, using xylazine as the immobilizing agent.

There have been four "incidents", or accidents to humans, related to the misuse of xylazine that should be recorded both for the veterinarians that prescribe this drug and for all that use it. While four seems on the surface to be a very small number, they almost certainly represent only the tip of a large iceberg. Most such accidents never reach the ears of anyone else. It is impossible to say what proportion of the true number they represent, but like an iceberg the surface is a deceptively small representation of the whole. This is not surprising as a mixture of embarrassment and fear seem to prevent the reporting of these accidents.

The first point to make is that this drug is controlled under schedule 1 part 1 of the federal Food & Drug Act. As such it may only be used on animals "**under the direct supervision of a licensed veterinarian**". If anything untoward occurs to a farmer who has the drug in his possession and is using it when the veterinarian is not present then it is **the veterinarian who is liable and may lose the license to practice.**

The incidents to which I refer have involved injection, ingestion and oral absorption of the drug. Only one has been recorded in the scientific literature. It is evident that the drug can be effective through mucous membranes as well as by injection. Xylazine is not used in human medicine, so it is difficult to be certain what effects it will have on anyone exposed to the drug. It is impossible to accurately predict what amount of xylazine will have any effect upon a human. The incidents outlined below merely give us some idea of a dose, and confirm that the effects in people are somewhat similar to those observed in animals.

High Dose

Case 1. In Ontario an individual is reported to have self-administered an injection of xylazine. The dose is not known, but thought to be about 10 mL of the large animal compound. When he was found he had completely collapsed. By the time he reached hospital he had stopped breathing. He remained on a respirator for 60 hours before recovering (1). Apparently this was not the only time that he had tried the drug, both as a sleeping aid and even for a suicide attempt.

Small dose

Case 2. In Western Canada a farmer inadvertently placed a needle cover in his mouth. The needle cover had been on a dart that had misfired. Presumably some of the drug had leaked into the plastic cover. He has extensive clinical experience and described to me the symptoms. Within minutes he felt "woozy". His face went numb and began to feel heavy. He says it felt just like the effect of "G" forces when flying a jet plane. His legs and arm. began to feel heavy. As he lost control of his limbs he asked if anyone in the room knew how to carry out CPR. Even when he was down on the floor he was aware of conversations, but quite unable to take part or move. An individual in the party had the presence of mind to get him to a local hospital. As he was moved to the truck he was able to talk again and began to brighten up. He soon felt drowsy again as the truck moved along. In hospital he spent 24 hours under observation before fully recovering.

Case 3. A veterinarian in the USA accidentally self-administered a small dose subcutaneously when a horse reared and hit him. He soon became very sleepy and was taken to hospital by the owner of the horse. He spent 24 hours under observation.

Minute dose

Case 4. Another case in the USA involved a situation in which an elk was sedated with xylazine before being slaughtered for a feast. Two people at the feast suffered effects. It is thought that both of these people ate cuts of the roast taken from the leg where the injection had been given. Apparently one of these people was somewhat "hyper" for several hours. The other also had peculiar sensations for several hours after the feed and the next day drove over 100 km. and then fell asleep at a job interview!

Behavioral toxicity

One feature of cases 1 & 2 was that in neither instance was there any appreciable slowing of the heart rate or decline in blood pressure. In this the cases differed from the usual course of events in other animals and from reported effects of this drug when it was being tested for possible use in humans. Case 4 illustrates what may be the single greatest risk associated with accidental exposure to this drug; both patients were unaware that they had been drugged. Their bizarre behavior was typical of what has been called "**behavioral toxicity**" which can lead to all sorts of unpleasant consequences, especially when vehicle driving is involved.

If you plan to use xylazine, and indeed some of the other drugs used in animal restraint, it is certainly worth informing your nearest medical center of what you are doing. As doctors do not have this drug in their armamentarium they have no experience with it. Even calls to poison centers have proved to be quite fruitless. There is virtually no information available.

The issue is of course much wider than merely the misuse of xylazine. Another class of drugs with abuse potential would be prostaglandins — even if they are not effective abortifacients in women. It is up to the provincial bodies to decide what truly qualifies as "under the direct supervision of a veterinarian". In my opinion handing out xylazine in a barely supervised situation is at least foolhardy, if not unprofessional.

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2. Carruthers SG, Nelson M, Stiller CR and HR. Xylazine Hydrochloride (Rompun) overdose in man. Clinical Toxicology. 1979; 15(3): 281-285.

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Joint Canadian/Saskatchewan Game Farmers Association Annual Meeting 1989
Wayside Inn, Lloydminster March 30th, 31st, and April 1st 1989

Friday 31st March

Management Matters. Chairman. Ed Hudson

8.30-9.15	The New Zealand Imports - How have they fared	Tony Pearse
9.15-10.00	The Wood Bison Story	Corm Gates
10.00-10.30	Coffee Break - Sponsored by Sask. Wheatpool Livestock Division	
10.30-11.15	Fallow Deer Management	Jerry Haigh
11.15-12.00	Management problems with NZ wapiti (elk)	Tony Pearse
12.00-1.15	Lunch - on your own	
	More management. Chairman Jerry Haigh	
1.15-1.45	Deer farming down under	Judit Smits
1.45-2.30	Antlers: form & function	Tony Bubenik
2.30-3.00	Federal H.of A. issues	Rick McLean
3.00-3.30	Coffee Break - Sponsored by Tanka Research	
3.30-4.00	Saskatchewan disease report	Judit Smits
4.00-4.30	Sask. Game Farming Technical Advisory Committee	Ron Lind
4.30-5.00	Feeding for antler growth	Tony Bubenik
6.00	Reception	
7.00	**Banquet, After dinner speaker:- The Honourable Joan Duncan** Minister of Economic Development & Tourism	

Auction sale - Courtesy of Moore's Auctions

Sat 1st April

Marketing - Goals for the future. Chairman Ryan Clark

8.30-9.00	Tanka Research Marketing Survey	Mary Degelman
9.00-9.30 Degelman	Marketing strategy panel	Dan Patten, Mary
		Len Schamerhorn
9.45-10.15	Forward development	Bill Norton
10.15-10.45	Coffee - Sponsored by Moore's Auctioneering Ltd.	
10.45-11.00	Preparing your farm & animal for sale	Norm Moore
11.00-11.30 Allewell	Live animal sales panel	Norm Moore, Don
11.30-12.15 McGuire	Antlers, buyers guide, panel	John Choi , Owen
		Rick Alsager

Lunch on your own 12.15

1.15-1.45	Canadian game Farmers Assn. Annual Meeting
1.45	Sask Game Farmers Assn AGM